(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 May 2005 (26.05.2005)

PCT

(10) International Publication Number
WO 2005/047651 A1

(51) International Patent Classification[7]: E21D 21/00

(21) International Application Number:
PCT/SE2004/001535

(22) International Filing Date: 22 October 2004 (22.10.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0302995-6 13 November 2003 (13.11.2003) SE

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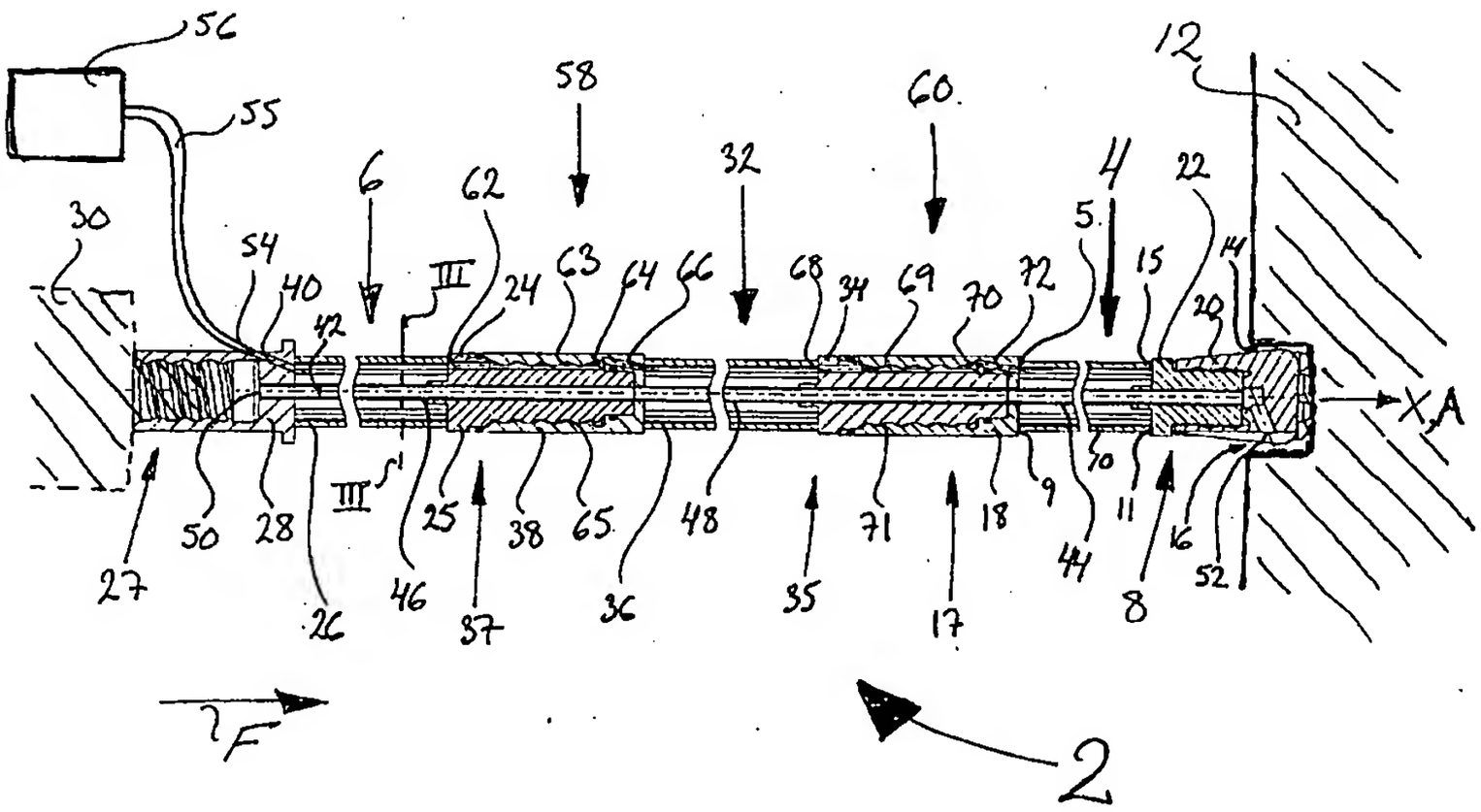
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: JOINTED SELF-DRILLING ROCK BOLT



(57) Abstract: The invention relates to a jointed self-drilling rock bolt (2) comprising at least two sections (4,6,32) joined together, where at least one of the sections (4,6,32) comprises an expandable part (10,26,36), and where the rock bolt (2) is self-drilling, the sections (4,6,32) are threaded together, and expanding fluid (40) for expanding the expandable part (10,26,36) is conveyed through at least one fluid passage (62,63,70,72) within a joint (58,59,60) between two sections (4,6,32) independent of the relative angle of rotation between the respective sections (4,6,32).

JOINTED SELF-DRILLING ROCK BOLT

Technical area

The present invention relates to a jointed self-drilling rock bolt.

Background of the invention

Different types of rock bolts, for example for supporting of the rock in order to increase its stability or for anchorage of suspension hooks or the like to the rock, are used for different types of rock. If the rock is solid, then a hole is usually drilled into the rock using a rock drill. Thereafter, the rock drill is removed from the hole and a rock bolt is subsequently inserted into the hole. If, on the other hand, the rock is non-solid, i.e. it comprises a multitude of cracks and the like, the hole will not remain fully open when the rock drill is removed thereby making it impossible to insert a rock bolt into the hole due to blocking rock material. In order to be able to arrange a rock bolt in non-solid rock usually a rock bolt of the self-drilling type is used, i.e. a rock bolt comprising a drill bit mounted thereon which drill bit is left in the rock together with the rock bolt, whereby the hole will remain free from blocking rock material due to the fact that no removal of the drill bit takes place.

A self-drilling rock bolt is shown in the Japanese patent application No. 2000-373505, which rock bolt comprises, in series, a rod for connecting the self-drilling rock bolt to a drilling apparatus, an expandable bolt part, and a drill bit unit comprising a holder for a drill bit and a drill bit, respectively. A drilling water supply pipe with a first end opening in the centre of rotation of the connector rod and a second opening on the surface of the drill bit extends from

the connector rod, through the inside the expandable part and to the drill bit unit.

A drawback with a rock bolt of the type mentioned above is that long rock bolts can not be installed in one piece in mines with low roofs or in narrow tunnels if the length of the rock bolt exceeds the height of the mine or the width of the tunnel. In some cases, the rock can be of such low quality that the rock bolts needed to sufficiently strengthen the rock are so long that the drilling rig is unable to handle the rock bolts in one piece.

Another drawback with the rock bolt mentioned above is that both end regions of said expandable part are unable to be subjected to large axial forces during the hammer drilling operation due to the construction of the joints between said end regions and the holder for the drill bit and the connector rod, respectively, whereby said drilling water supply pipe has to be strong enough to withstand any large axial drilling forces.

Summary of the invention

It is an object of this invention to solve the problem of installing long rock bolts in narrow spaces, by arranging a jointed self-drilling rock bolt comprising several sections joined together, preferably threaded together, where at least one section comprises an expandable part.

It is further an object of the invention to solve the problem of delivering drilling fluid to the drill bit, and expanding fluid to the parts that are to be expanded.

It is also an object of this invention to solve the problem of improving the axial stability of the rock bolt by arranging a jointed self-drilling rock bolt where the axial forces during

a hammer drilling operation can propagate in an essentially axial direction within each section of the rock bolt, and where the joints between different sections in the rock bolt are stronger than the sections in the axial direction.

By arranging a self-drilling rock bolt comprising the features in independent claim 1, it is possible to insert long rock bolts from narrow spaces into rock by joining sections of the rock bolt together during the drilling operation. It is further possible to insert long rock bolts into rock using short feeding devices.

Further preferred features are included in the dependent claims.

By arranging a self-drilling rock bolt comprising the features in the dependent claims, drilling fluid is delivered without difficulty to the drill bit unit, and axial forces during a hammer drilling operation can propagate in an essentially axial direction through said sections thus improving the axial stability of the rock bolt as the rock bolt is able to withstand large axial forces without collapsing.

List of figures

The invention is now described by way of a preferred non-limiting example with reference to the appended drawings, wherein:

Figure 1 shows a longitudinal section of a jointed self-drilling rock bolt according to one embodiment of the invention.

Figure 2 shows a longitudinal section of a joint in a jointed self-drilling rock bolt.

Figure 3 shows a cross-section of a jointed self-drilling rock bolt along line III-III in figure 1.

Detailed description of preferred embodiments

Figure 1 shows a longitudinal section of a jointed self-drilling rock bolt 2 according to one embodiment of the invention. The self-drilling rock bolt 2 comprises at least two sections, a front section 4 and a rear section 6, preferably joined together by threads or otherwise connected together, where at least one section comprises an expandable part.

In this embodiment, said front section 4 comprises at least three main parts: firstly, a drill bit unit 8; secondly, an intermediate expandable part 10 intended to be expanded after the rock bolt 2 has been fully inserted in position within a rock 12 in order to lock said rock bolt 2 mechanically to the internal radial surface 14 of a hole 16 drilled into the rock 12; and thirdly, a connector part 18 intended for connecting the rear end 17 of the front section 4 of the rock bolt 2 to a front end of another section of said rock bolt 2. The drill bit unit 8 may comprise a drill bit 20 intended to be used for drilling a hole 16 into a rock 12, or a holder 22 for a drill bit 20 and a drill bit 20, respectively.

Said rear section 6 also comprises at least three main parts: firstly, a connector part 24 intended for connecting the front end 25 of the rear section 6 of the rock bolt 2 to a rear end of another section of said rock bolt 2; secondly, an intermediate part 26; and thirdly, a connector part 28 intended for connecting the rear end 27 of the rear section 6 of the rock bolt 2 to a drilling apparatus 30. Said intermediate part 26 may be an expandable part of the same type as in the front section 4 of the rock bolt 2, but it may

also be a non-expandable part intended to convey drilling fluid, percussion force, rotation and expanding fluid, respectively, from the drilling apparatus 30 or another fluid source to the front section 4 of the rock bolt 2.

The self-drilling rock bolt 2 may further comprise one or more intermediate sections 32, where said intermediate section(s) also comprise at least three main parts: firstly, a connector part 34 intended for connecting the front end 35 of the intermediate section 32 of the rock bolt 2 to a rear end (e.g. 17)of another section (e.g. 4) of said rock bolt 2; secondly, an intermediate part 36; and thirdly, a connector part 38 intended for connecting the rear end 37 of the intermediate section 32 of the rock bolt 2 to a front end (e.g. 25) of another section (e.g. 6) of said rock bolt 2. Said intermediate part 36 may be an expandable part of the same type as in the front section 4 of the rock bolt 2, but it may also be a non-expandable part intended to convey expanding fluid 40, and in some embodiments also drilling fluid 42, from the drilling apparatus 30 or another fluid source to the front section 4 of the rock bolt 2.

In the following description of the preferred embodiment of the invention, the drill bit unit 8 comprises a holder 22 for a drill bit 20 and a drill bit 20, respectively, where the front end 11 of said intermediate expandable part 10 of said front section 4 of the rock bolt 2 is joined to the holder 22.

In order to be able to transport drilling fluid 42, usually water 42, from said drilling apparatus 30, or any other fluid source, to the holder 22 for the drill bit 20, and from there on right through the drill bit 20, each of the sections 4;6;32 in the rock bolt 2 preferably also comprise a fourth part consisting of a drilling fluid supply pipe 44;46;48 located

along the axis of rotation X of the rock bolt 2. Said fluid supply pipes 44;46;48 together with a rear opening 50 in the connector part 28 intended for connecting the rear end 27 of the rear section 6 of the rock bolt 2 to a drilling apparatus 30 and a front opening 52 in the drill bit 20, form a channel for drilling fluid 42 extending from said connector part 28 surface to said drill bit 20 surface when the rock bolt 2 is in its assembled state as shown in figure 1.

The expanding fluid 40 is preferably conveyed from a fluid source 56, via a pipe 55 and through an inlet 54 in the connector part 28 intended for connecting the rear end 27 of the rear section 6 of the rock bolt 2 to a drilling apparatus 30, through the intermediate parts 26,36,10 thereby reaching those of the intermediate parts 26,36,10 that are to be expanded after the rock bolt 2 has been fully inserted in position within a rock 12 in order to lock said rock bolt 2 mechanically to the internal radial surface 14 of a hole 16 drilled into the rock 12. Joints 58,60 comprising at least one fluid passage 62,64,66;68,70,72 are arranged between said intermediate parts 26,36,10 in order for the expanding fluid 40 to be able to flow through the joints 58,60.

Figure 2 shows a longitudinal section of a joint 59 in a jointed self-drilling rock bolt 2.

In the following description an embodiment with only two sections 4,6 and thus only one joint 59 is described, but it is to be understood that there can be any number of joints, i.e. one 59, two 58,60(see e.g. figure 1), or more, depending on the desired length of the rock bolt 2 and the desired number of sections 4,6,32. All the joints 58,59,60 are of similar construction.

Figure 2 thus shows a longitudinal section of a joint 59 in a jointed self-drilling rock bolt 2, where a front section 4 and a rear section 6 of the rock bolt 2 are joined together. As has been previously described the front section 4 has an intermediate part 10, which may or may not be expandable, intended for conveying expanding fluid 40, and also a connector part 18 intended for connecting the rear end 17 of the front section 4 to a front end of another section, in this embodiment the front end 25 of the rear section 6. As has been previously described the rear section 6 has an intermediate part 26, which may or may not be expandable, intended for conveying expanding fluid 40, and also a connector part 24 intended for connecting the front end 25 of the rear section 6 to a rear end of another section, in this embodiment the rear end 17 of the front section 4. The two connector parts 18,24 mentioned above are preferably threaded together.

In order to be able to transport drilling fluid 42, usually water 42, from said drilling apparatus 30, or any other fluid source, to the holder 22 for the drill bit 20, and from there on right through the drill bit 20, each of the sections 4;6 preferably also comprise a drilling fluid supply pipe 44;46 located along the axis of rotation X of the rock bolt 2, in order to separate the drilling fluid 42 from the expanding fluid 40.

The expanding fluid 40 is conveyed from the interior of the intermediate part 26 in the rear section 6, through at least one fluid passage 62,63,70,72 arranged within the joint 59, and to the interior of the intermediate part 10 in the front section 4. The fluid passage preferably comprises a first part 62 in the form of at least one hole 62 in the connector part 24 at the front end 25 of the rear section 6, a second part 63 in the form of at least one groove 63 in the thread 65 in said

connector part 24, a third part 70 in the form of an annular channel 70 in the connector part 18 at the rear end 17 of the front section 4, and a fourth part 72 in the form of at least one hole 72 in the connector part 18 at the rear end 17 of the front section 4. It is also possible to arrange the at least one groove in the thread in the in the connector part 18 at the rear end 17 of the front section 4, and the annular channel in the connector part 24 at the front end 25 of the rear section 6. By having a annular channel 70 it is not necessary to align the holes 62,72 with the groove 63 in order to keep the fluid passage open, i.e. the fluid passage will stay open independent of the relative angle of rotation between the respective connector parts 18,24, i.e. the respective sections 4,6, mentioned above. Annular sealings are arranged at each end of the thread 65 to stop leakage from the joint 59.

It is possible to let the drilling fluid 42 use the intermediate parts 26,36,10 as a pipe, in the same way as the expanding fluid 40. In this case some means for closing off the fluid opening in the drill bit unit 8 must be arranged. Otherwise, expanding those of the intermediate parts 26,36,10 that are to be expanded will be difficult as the expanding fluid 40 will continuously keep leaking out through the opening 52 in the drill bit unit 8 thus making it difficult to build up a preferred expanding pressure in the expanding fluid 40 situated within those of the intermediate parts 26,36,10 that are to be expanded. The pressure in the drilling fluid 42 is much lower than that in the expanding fluid 40. Therefore, the closing off of said opening may for example be executed using a pressure or rotation controlled vent (not shown) in the opening 52 which vent closes when the pressure in the expanding fluid 40 exceeds a threshold. Thus, when the

expanding fluid 40 is conveyed at a high pressure into the opening, said vent closes thus expanding the walls of those of the intermediate parts 26,36,10 that are to be expanded until they come into contact with the radial surface 14 inside the drill hole 16. The expanding fluid 40 and the drilling fluid 42 may be the same fluid such as water fed from the same fluid source and through the same opening 50,54, or two different fluids such as liquid concrete and water fed from two different fluid sources.

The problem of improving the axial stability of the rock bolt 2 is solved according to the invention by arranging a jointed self-drilling rock bolt 2 where the three main parts 8,10,18;24,26,28;34,36,38 in a section 4,6,32 of the rock bolt 2 are aligned and joined together in a way that allows the axial forces F during a hammer drilling operation to propagate in an essentially axial direction A through said three main parts 8,10,18;24,26,28;34,36,38, thus maximizing the stability of said sections 4,6,32, and where the joints 58,59,60 between the sections 4,6,32 are arranged to be stronger than said sections 4,6,32 in the axial direction A.

In the following description one section, the front section 4, is described, but all the sections 4,6,32 have a similar construction regarding the joining of the three main parts 8,10,18; 24,26,28; 34,36,38 within each section 4,6,32.

As can be seen in figure 1, the intermediate expandable part 10 is joined at a first end to a connector part 18 and at a second end to a holder 22 for a drill bit 20. Said connector part 18 abuts against the first axial end surface 9 of said expandable part 10 thereby forming a first contact region 5, and said holder 22 for the drill bit 20 abuts against the second axial end surface 11 of said expandable part 10 thereby

forming a second contact region 15. Said expandable part 10, said first contact region 5, and said second contact region 15 all have cross-sections that at least partly overlap each other when seen axially along said rock bolt 2, thereby allowing axial forces during a hammer drilling operation to propagate in an essentially axial direction from said connector part 18 via said expandable part 10 into said holder 22 for the drill bit 20, thus improving the axial stability of the rock bolt 2. Said expandable part 10 is preferably joined to said connector part 18 and said holder 22 for said drill bit 20, respectively, by welding but it is also possible to use another joining method, e.g. soldering or an adhesive if the resulting joint becomes sufficiently strong. Welding methods that may be used comprises, but are not limited to, resistance welding, friction welding and electron beam welding.

Figure 3 shows a cross-section of the self-drilling rock bolt 2 along line III-III in figure 1. Both the outer periphery 25 and the inner periphery 27 of one of the intermediate parts 26 of said rock bolt 2 has a symmetrical cross-section forming a cross-like shape having an inner channel 45 also with a cross-like shape as shown in figure 3. The wall thickness between the inner periphery 27 and the outer periphery 25 is preferably equal throughout said cross-section. Said expandable part thus forms a pipe-like device preferably with room for a drilling fluid supply pipe 46 in the centre. All the intermediate parts 26,36,10 have a similar construction regarding the cross-section.

Symmetrical cross-sections for the intermediate parts 26,36,10 of the rock bolt 2 other than the one shown in figure 3 are also possible to use preferably with room for a drilling fluid supply pipe 46,48,44 located along the axis X of rotation of

the intermediate rock bolt part 26,36,10. Although symmetrical cross-sections are preferred, non-symmetrical cross-sections are also possible to use, preferably with room for a drilling fluid supply pipe 46,48,44 located along the axis X of rotation of the intermediate rock bolt part 26,36,10. Due to the enhanced stability of the intermediate rock bolt part 26,36,10, it is also possible to arrange said drilling fluid supply pipe 46,48,44 radially displaced from said axis X of rotation but such an arrangement results in a more complicated and more expensive execution of the invention.

Claims

1. A jointed rock bolt comprising at least two sections (4,6,32) joined together, where at least one of the sections (4,6,32) comprises an expandable part (10,26,36), characterized in, that
- the rock bolt (2) is self-drilling,
- the sections (4,6,32) are connected together, and that
- a joint (58,59,60) is arranged between two sections (4,6,32), said joint (58,59,60) having at least one fluid passage (62,63,70,72) for conveying expanding fluid (40) for expanding the expandable part (10,26,36), where the fluid passage (62,63,70,72) comprises an annular channel (70) in a section connector part (18;24;38;34) thus keeping the fluid passage (62,63,70,72) open independent of the relative angle of rotation between the respective sections (4,6,32).

2. A jointed self-drilling rock bolt according to claim 1, characterized in, that
- the front section (4) comprises at least three main parts: firstly, a drill bit unit (8); secondly, an intermediate expandable part (10); and thirdly, a connector part (18) intended for connecting the rear end (17) of the front section (4) of the rock bolt (2) to a front end of another section (6,32) of said rock bolt (2), and that
the rear section (6) comprises at least three main parts: firstly, a connector part (24) intended for connecting the front end (25) of the rear section (6) of the rock bolt (2) to the rear end of another section (4,32) of said rock bolt (2); secondly, an intermediate part (26);

and thirdly, a connector part (28) intended for connecting the rear end (27) of the rear section (6) of the rock bolt (2) to a drilling apparatus (30), and that
- the intermediate part (26) in the rear section (6) is an expandable part, or a non-expandable part intended only to convey drilling fluid (42) and expanding fluid (40), respectively, from the drilling apparatus (30) or another fluid source to the front section (4) of the rock bolt (2).

3. A jointed self-drilling rock bolt according to claim 2, characterized in, that
- the self-drilling rock bolt (2) further comprises one or more intermediate sections (32), where said intermediate section(s) also comprise at least three main parts: firstly, a connector part (34) intended for connecting the front end (35) of the intermediate section (32) of the rock bolt (2) to a rear end (e.g. 17) of another section (e.g. 4) of said rock bolt (2); secondly, an intermediate part (36); and thirdly, a connector part (38) intended for connecting the rear end (37) of the intermediate section (32) of the rock bolt (2) to a front end (e.g. 25) of another section (e.g. 6) of said rock bolt (2), and that
- said intermediate part (36) is an expandable part, or a non-expandable part.

4. A jointed self-drilling rock bolt according to claim 2 or 3, characterized in, that
the expanding fluid (40) is conveyed through the intermediate parts (26,36,10) of the sections (6,32,4) from a fluid source to those of the intermediate parts (26,36,10) that are to be expanded via at least one joint (58,60) comprising at least one fluid passage

(62,64,66;68,70,72) between said intermediate parts (26,36,10).

5. A jointed self-drilling rock bolt according to claim 4, characterized in, that
when the rock bolt (2) is in its assembled state the drilling fluid (42) is transported from a fluid source to the drill bit unit (8) through a channel formed by drilling fluid supply pipes (44;46;48) located in each of the sections (4;6;32) along the axis of rotation (X) of the rock bolt (2).

6. A jointed self-drilling rock bolt according to claim 4, characterized in, that
the fluid passage (62,64,66;68,70,72) comprises a first part (62;68) in the form of at least one hole in the connector part (24;34) at the front end (25;35) of a rearward section (6;32), a second part (63;69) in the form of at least one groove in the thread (65;71) in said connector part (24;34), a third part (64;70) in the form of an annular channel in the connector part (18;38) at the rear end (17;37) of a forward section (4;32), and a fourth part (72;66) in the form of at least one hole in the latter connector part (18;38) at the rear end (17;37) of the forward section (4;32).

7. A jointed self-drilling rock bolt according to any of claims 2 to 6, characterized in, that
- the intermediate part (10;26;36) is joined at a first end to the third main part (18;28;38) and at a second end to the first main part (8;24;34), and that
- said third main part (18;28;38) abuts against the first axial end surface (e.g. at 9) of said intermediate part (10;26;36) thereby forming a first contact region (e.g.

at 5), and that

- said first main part (8;24;34) abuts against the second axial end surface (e.g. at 11) of said intermediate part (10;26;36) thereby forming a second contact region (e.g. at 15), and that

- said intermediate part (10;26;36), said first contact region (e.g. at 5), and said second contact region (e.g. at 15) all have cross-sections that at least partly overlap each other when seen axially along said rock bolt (2), and that

- the joints (58,59,60) between the sections (4,6,32) are arranged to be stronger than said sections (4,6,32) in the axial direction (A) thereby allowing axial forces during a hammer drilling operation to propagate in an essentially axial direction thus improving the axial stability of the rock bolt (2).

8. A jointed self-drilling rock bolt according to claim 7, characterized in, that
the intermediate part (10;26;36) is joined at a first end to the third main part (18;28;38) and at a second end to the first main part (8;24;34), respectively, by welding.

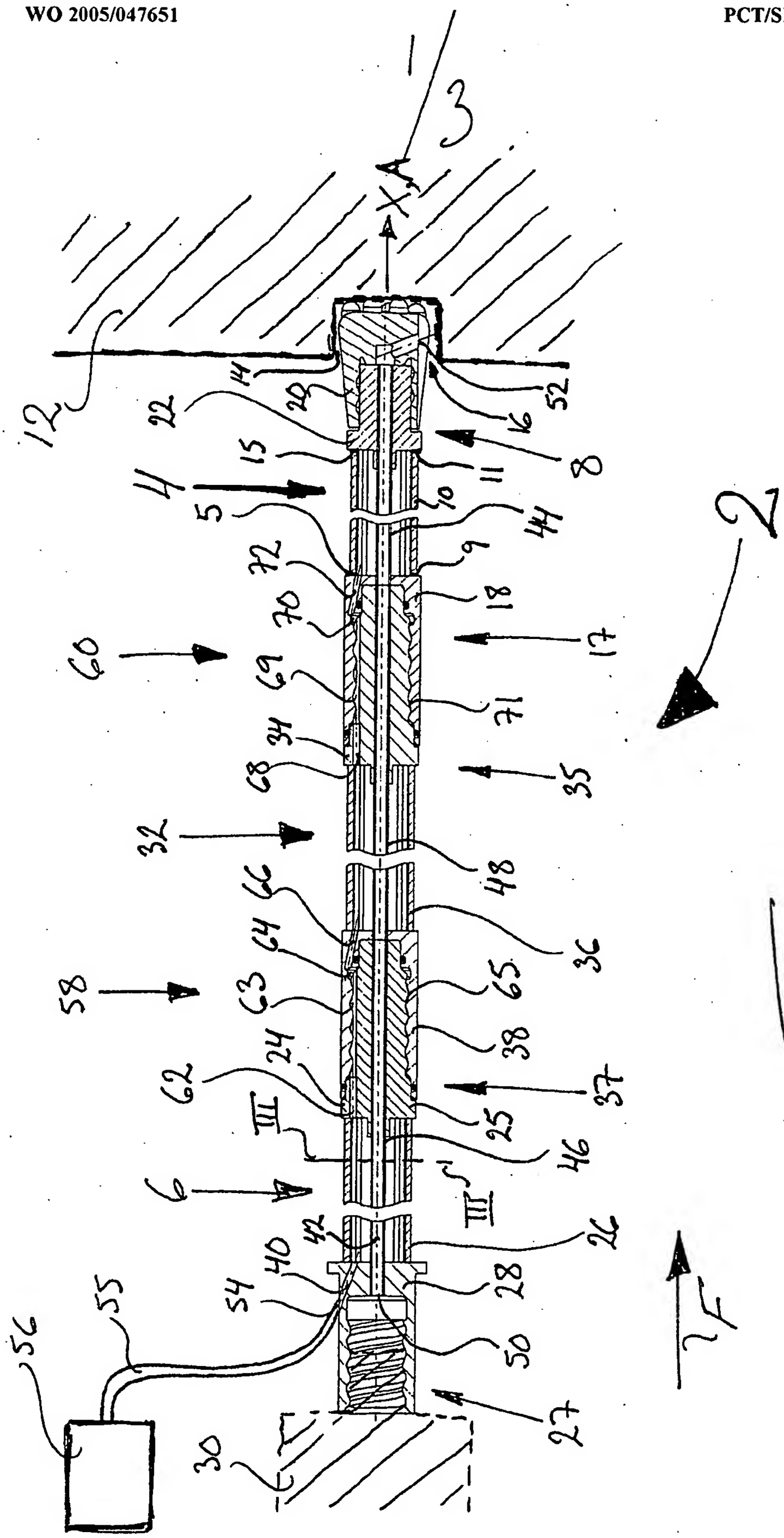

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Fig. 1

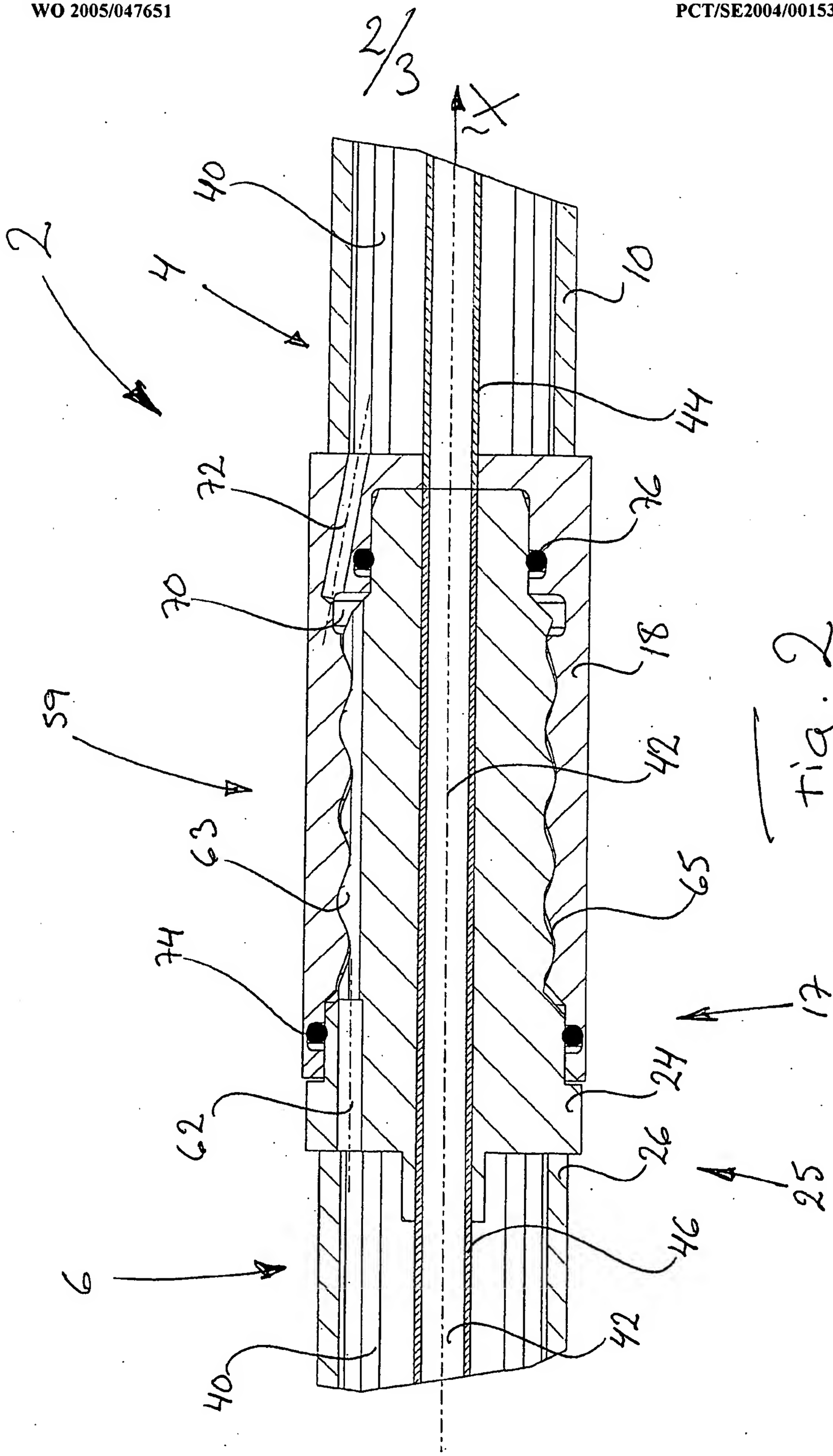

Fig. 2

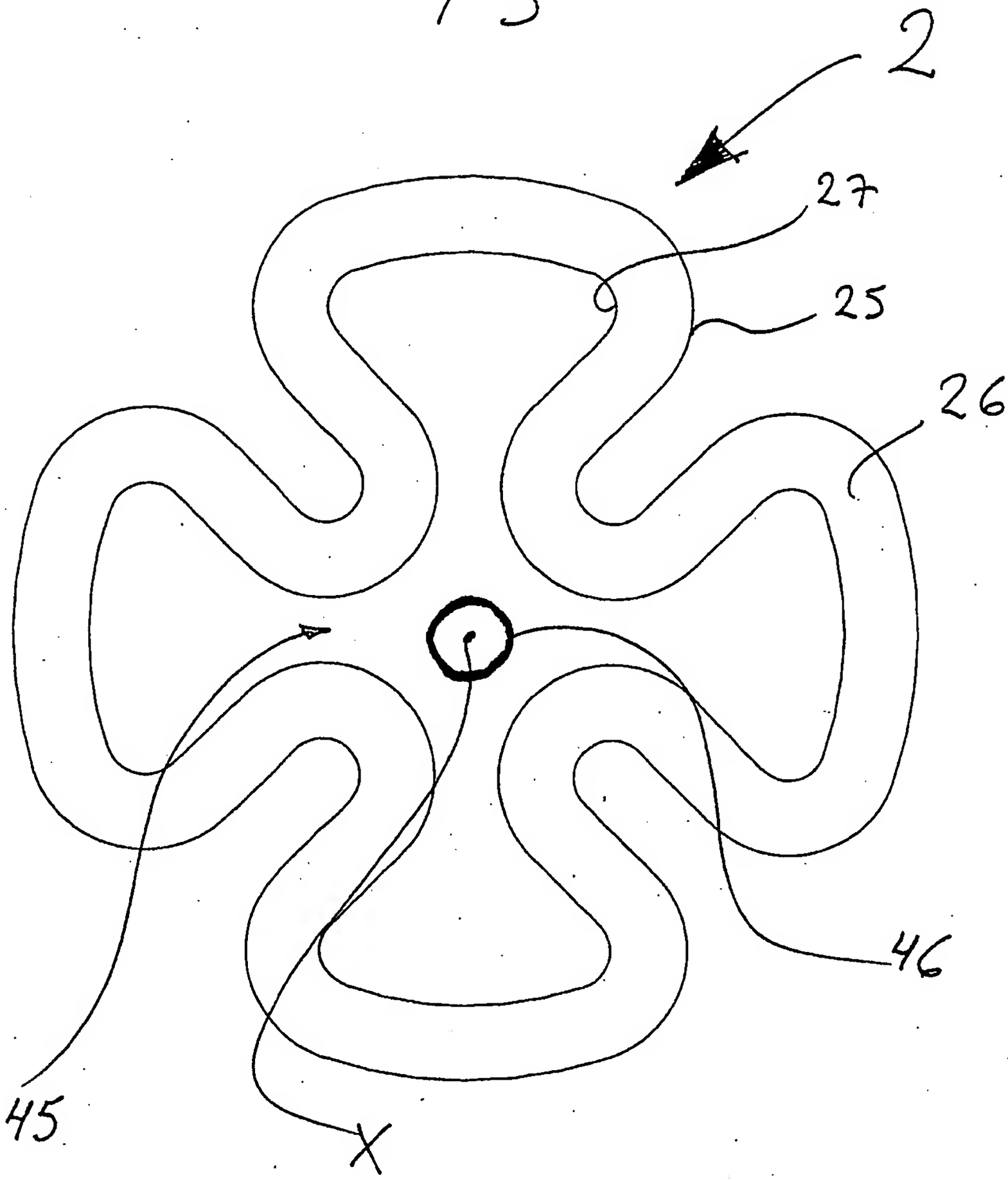

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 2004/001535

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E21D 21/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AT 394248 B (MAGYAR ALUMINIUMIPARI TRÖSZT), 25 February 1992 (25.02.1992) --	1-8
A	WO 03062599 A1 (TECHMO ENTWICKLUNGS- UND VERTRIEBS GMBH ET AL), 31 July 2003 (31.07.2003) --	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
1 February 2005	18 -02- 2005
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Christer Bäcknert / MRo Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (January 2004)

AT	394248	B	25/02/1992	AT	329686	A 15/08/1991
				CS	8700144	A 15/09/1991
				CZ	278263	B 17/11/1993
				DD	252854	A 30/12/1987
				HU	42819	A 28/08/1987
				HU	196477	B 28/11/1988
				PL	153395	B 30/04/1991
				PL	263577	A 16/11/1987
				SK	278449	B 04/06/1997
WO	03062599	A1	31/07/2003	AT	972002	A 15/11/2004
				CA	2473255	A 31/07/2003
				EP	1468167	A 20/10/2004
				US	20040231890	A 25/11/2004